ADAPTER FOR LIGHT EMITTING APPARATUS USED IN THE MEDICAL FIELD

Cross Reference to Related Application

The present application claims priority from pending Austrian Patent Application No. A 253/2003, filed February 20, 2003, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field

The invention presented here concerns an adapter for a handpiece system, especially for use in conjunction with medical and dental light emitting apparatus for the transmission of light such as may be used to cure photo-polymerisable materials, particularly for the filling of cavities and securing of braces, as well as for providing proof of caries or for bleaching the surface of teeth.

Description of Prior Art

The power supply for light emitting apparatus of this kind is provided either by means of batteries, which are housed in the hand-held equipment, as described in the FR 2818892 A1, for example, and / or through connection to an external power, or voltage source. As a preference, this is effected by coupling the light emitting apparatus to a supply hose, or conduit, provided for those air-driven appliances present in a dental unit. This enables the light emitting apparatus to be used as part of the existing, familiar unit without incurring any additional procurement costs for control devices.

Supply hoses for air-driven appliances contain several media supply lines, including a twin-pole power lead for a power supply with voltage of 3.3V. In accordance with certain standards, such as European Standard, EN 29168 (=ISO 9168), the two ends of the power lead exit at a prescribed point in the form of electrical contacts, located at an appropriate distance from other media supply lines and integral with the plane surface ending at the connection of the supply hose. This standard, however, contains no directions with regard to the arrangement of the two contacts' polarity and this is not noted during assembly of the dental unit or connection of the supply hoses, which in the end means that it is impossible to tell which of the two contacts represents the positive or negative poles. This is not necessary in usual practice, since small light bulbs located in the air-driven appliances for merely illuminating the preparation area are fed via these contacts, and they light up irrespective of the polarity arrangement.

In contrast to this, it is an absolute necessity to identify the polarity of the supply hose contacts when operating specialized light emitting apparatus (and before its initial use) and to match this polarity to that of the contacts of the light emitting apparatus, since light-emitting diode(s) (LED) used in the light emitting apparatus rely on correct connection.

Determining the polarity of the two contacts is a task currently carried out by a service technician, who has to make a special trip to the user for this purpose. If the polarity of the contacts of the supply hose does not match the contact arrangement in the light emitting apparatus, then the technician cross-plugs the connections of the supply hose in the dental unit.

One manufacturer provides a test appliance with each piece of light emitting apparatus, with the aid of which the user can himself establish whether the contact arrangement in the supply hose matches that in the light emitting apparatus. But even in this case a service technician has to carry out any possibly necessary correction to the supply hose connection. Both variants, therefore, are extremely time consuming and costly.

Because of this, there exists an urgent need for a simpler and cheaper solution which enables the user himself to put the light emitting apparatus into operation without specialist support.

SUMMARY OF THE INVENTION

This task is, in accordance with the invention presented here, resolved by a device, e.g. in the form of an adapter which accommodates matching the polarity of contacts within a handpiece system including at least two separable components.

Another aspect of the invention is to provide light-emitting apparatus for a handpiece system with a light source contained therein and contacts for connecting to an external power source, and an adapter to match the polarity of contacts.

In accordance with an aspect of the invention, the adapter contains leads for providing an electrical power, or voltage supply to the light emitting apparatus, whereby these leads are either in the form of continuous, uninterrupted leads and the adapter can be rotated about its longitudinal or lateral axis in relation to the light source contacts, or the leads are sub-divided into sections, comprised of rigid and movable sections, and in which different lead routings can be produced by connecting the movable sections to the rigid sections.

In one embodiment the adapter contains two leads, which in each case end adjacent both ends of the adapter in pairs as contacts, whereby the two leads are routed in such a way that they cross each other within the adapter, so that the arrangement of the contacts at both ends of the adapter is exactly reversed. The user can now insert this adapter into the handpiece system (consisting of at least one piece of light emitting apparatus and one supply hose) in any arbitrarily selected position, plug the handpiece system and adapter together and then put the system into operation and, if it is not possible to operate the light emitting apparatus, disconnect the handpiece system, turn the adapter through 180° about its lateral axis and then

reconnect it to the handpiece system in this position in order to be able to subsequently operate the light emitting apparatus.

In another embodiment, the connection of the light emitting apparatus to the supply hose is made via a rotary coupling equipped with slip rings for voltage transmission at its distal end. The adapter is positioned between the light emitting appliance and the coupling, and the connection of the light source to an external voltage source is effected via slide contacts in the adapter, which make contact with the coupling's slip rings. A suitable contact is made by rotating the coupling about its longitudinal axis in relation to the contacts of the light source.

In yet another embodiment, the adapter forms part of the light emitting apparatus or of the sleeve of the handpiece system, consisting of at least one supply hose with a distal coupling device with contacts for voltage transmission from an external voltage source and one handle containing a light source, contacts for connecting the light source to an external voltage source and one proximal coupling device. This reduces the number of interfaces and break points at which dirt particles or disease pathogens can collect.

Another aspect of the invention is to provide a simplified process which enables the user, with the aid of an adapter made in accordance with the invention, to make a suitable contact without requiring the support of a service technician.

The invention is explained by means of preferred embodiments and in reference to the enclosed drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows, in the form of an exploded view, a handpiece system complete with an adapter according to an embodiment of the invention;

Fig. 2 is an enlarged longitudinal section view of the excerpt labeled A in Figure 1.

Figs. 3A and 3B show in detail an adapter fixed into the handle sleeve at two different, predetermined positions, forming a detachable connection with the light source contacts.

Figs. 4A and 4B show an alternative design example of the adapter with two different modes of contact.

Fig. 5 shows in exploded view a handpiece system with a handpiece turbine and an adapter.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The same components are labeled with the same numerals in all figures.

The descriptive terms used here, 'distal' and 'proximal', refer to orientation of the apparatus relative to the dental unit (treatment chair) to which the handpiece system is connected: "Proximal" means the side of a component nearer in the line of connection to the dental unit, whilst "distal" means the side away and further in the line of connection from the dental unit.

Figure 1 illustrates a handpiece system 1 consisting of light emitting apparatus 2, a rotary coupling 3 and supply hose, or conduit, 4 in which an adapter 5, produced in accordance with the invention, is inserted. At the distal end of the light emitting apparatus 2, a light conductor 6 is arranged which conducts the light produced by a light source (not shown), also referred to as an electrical operating element, contained in the light emitting apparatus 2 to the point of treatment. The adapter 5 is designed as a component of the light emitting apparatus 2 and is fixed to the handle sleeve 10 via an end cap 7. A rotary coupling 3 is then connected, via which a connection with the supply hose 4 and an external electrical power, or voltage, source is made and which simultaneously guarantees that the light emitting apparatus 2 is free to rotate with respect to the supply hose 4.

The detailed section shown in Figure 2 corresponds to the excerpt labeled "A" in Figure 1. Both the adapter 5 and the proximal end of the light emitting apparatus 2 can be seen. The adapter 5 consists of an adapter housing 26, through which two continuous, uninterrupted leads 16 and 17 are routed, which end at their distal points (at the left in Fig. 2) in the form of non-rotatable, detachable contacts, preferably as plug contacts 14 and 15, but whereby other types of detachable contacts, e.g. spring contacts, are conceivable. Contacts 14 and 15 of the leads 16, 17 of the adapter 5 can be plugged into plug terminals, or contacts, 12 and 13 in handle sleeve 10 by pushing the adapter 5 through the aperture 29 of the light emitting apparatus 2 into a hollow space 28 formed by the handle sleeve 10. Contact can be made through two possible, predetermined positions of adapter 5: contact 14 and plug terminal 13, as well as contact 15 and plug terminal 12, can be connected to each other (position 1) as shown in Figure 2 and 3A. Contact 14 and plug terminal 12, as well as contact 15 and plug terminal 13, can be connected to each other by turning adapter 5 through 180° about its longitudinal axis (position 2) as seen in Fig. 3B. The voltage supply, or electrical power supply, is transmitted to circuit board 27, which is fixed to the handle sleeve 10 by means of positioning pins 11, and to the light source via plug terminals 12 and 13.

The proximal ends of leads 16 and 17 of the adapter 5 (adjacent the right end in Fig. 2) are in the form of slide contacts 24 and 25, or connectors, and project, supported by a bracket 18, radially inward. An end portion 3A of the coupling 3, connected to the supply hose 4, is inserted into the hollow space 30 of the adapter 5 via the lock 19, thus creating a handpiece system 1 which corresponds to Figure 1. Arrow 3B in the figures points to an open end of lock 19 through which end portion 3A may be inserted.

Figure 3A shows the adapter 5 inserted into the end piece of the handle sleeve 10, whereby plug contact 13 is connected to contact 14 and plug terminal 12 to contact 15 (corresponds to position 1). The coupling 3, which connects to the adapter 5, has a coupling spigot 20, on which two gasket rings 21 and two slip rings 22 and 23 are located. Coupling 3 is illustrated in position to be inserted axially (moving to the left in Figs. 3A, 3B) into couple engagement with adapter 5, such that end portion 3A enters space 30. Inserting the coupling spigot 20 into the adapter 5 produces contact between slide contacts, or connectors, 24, 25 and slip rings 22, 23. The slip rings 22 and 23 are connected to electrical leads in the supply hose 4 via leads and plug contacts in coupling 3, which means that, if the individual appliances are joined together in accordance

with Figure 1, a supply electrical power, or voltage, to the electrical operating element, or light source in the handle sleeve 10 of the light emitting apparatus is effected in the familiar manner by an external electrical power, or voltage source via contacts 12-15, leads 16, 17, their contacts 24, 25, slip rings 22, 23, coupling 3 and supply hose 4.

What may remain unknown, however, is the polarity of the two slide contacts 22 and 23, since power is normally supplied via these contacts to small light bulbs contained in air-driven appliances in order merely to illuminate the preparation area, and they light up irrespective of the polarity arrangement. In contrast to this, the LEDs used in the specialized light emitting apparatus 2 rely on the correct polarity contact arrangement being produced. This means that the contact arrangement represented in Figure 3A might make operation of the light emitting apparatus 2 impossible, since slip ring 23, which represents the negative pole, is connected via slide contact 25, lead 17 and plug contact 14 to plug terminal 13, which, however, is connected to the positive pole of the light source. The same applies to slip ring 22 as a positive pole connected via slide contact 24, lead 16 and plug contact 15 to terminal 12, and thus to the negative pole of the light source (position 1).

However, with the aid of adapter 5, produced in accordance with an embodiment of the invention, the user can alter the contact arrangement (position 2), see Figure 3B. To do this coupling 3 is disconnected from the adapter 5 and the adapter 5 is taken out of the handle sleeve 10, turned through 180° about its longitudinal axis into a second possible, predetermined position and then once again reinserted into the handle sleeve. The new contact arrangement now runs from slip ring 23, which represents the negative pole, via slide contact 25, lead 17 and plug contact 14 to plug terminal 12, which is connected to the negative pole of the light source, and via slip ring 22 as the positive pole, slide contact 24, lead 16 and plug contact 15 to terminal 13 and thus to the positive pole of the light source (position 2). The correct contact arrangement is thus established correctly and the light emitting apparatus can be operated. Since the adapter 5 is connected to the light source via plug contacts 12-15 in a fixed manner, and is further secured by the end cap 7 (Figure 1), selection of the correct position by the user only has to be carried out once, as part of the initial start-up procedure for the light emitting apparatus 2.

In an alternative embodiment of the adapter 5 represented in Figures 4A and 4B, leads 16 and 17 are divided into several sections 16A, 16B, 16C and 17A, 17B, 17C respectively. The rigid sections 16B, 16C, 17B and 17C are connected to slide contacts 24 and 25, and movable sections 16A and 17A are connected to plug contacts 14 and 15. The movable lead sections 16A and 17A can be connected to the rigid sections 16B and 17C, respectively (position 1, Figure 4A), or to sections 16C and 17B respectively (position 2, Figure 4B) via an operating element, preferably a switch (not shown), in order to produce different lead routings and thus the correct contact arrangement. One advantage of this design example is simpler operation, since the user only has to undo the end cap 7 from the handle sleeve 10, without having to take the adapter 5 out of the handle sleeve 10 or the light emitting apparatus 2 and to turn the adapter into a suitable position. Contacts 12-15 in this design example can be connected to each other in a fixed manner instead of being detachable.

In an especially preferred design example the switch of the adapter 5 is effectively connected to a further operating element located on the outside of handle sleeve 10, which also means that the user no longer has to undo end cap 7 in order to be able to select the desired contact arrangement.

The invention is not restricted to the depicted design examples. In particular, the adapter 5 can be in the form of an independent component or form part of any arbitrary appliance belonging to the handpiece system 1. The arrangement of the adapter 5 also is not restricted to the proximal end of the light emitting apparatus 2 or the handle sleeve 10, but rather the adapter 5 can be attached to or inserted into any component belonging to handpiece system 1.

In the case of the rotary adapter shown in Figures 3A and 3B, the angle of rotation between the possible, predetermined positions is not restricted to a certain dimension, but depends on the arrangement of the contacts within the component to which the adapter 5 is attached.

Moreover, the arrangement of slide contacts 24, 25 and slip rings 22, 23 to certain components is only meant to serve as an example and the opposite is possible in the sense of kinematic reversal.

In addition to use in light emitting apparatus, the adapter 5 also can be deployed in handpiece systems with other surgical and medical instruments, which are equipped with LEDs, such as, for example, turbine handpieces, motor-driven straight and contra-angled handpieces, laser handpieces, syringe devices for spraying water, scalers for removing tartar, saws, medical camera handpieces, endoscopes, mirrors or cold light sources for illuminating operation areas. As an example, Figure 5 shows an air driven turbine handpiece 40 forming part of the handpiece system 1. The turbine handpiece 40 has a head 41 to which a tool 42, e.g. a burr, is coupled detachably via a chuck. One or more LEDs are disposed inside the turbine handpiece 40, preferably in the handle sleeve 44, either close to an opening 43 from which the light is projected onto the treatment site and the tip of the tool 42, or remote from opening 43. In the latter case the light is transmitted from the LEDs to the opening 43 via a light guide, e.g. a glass or fibre glass rod.

Usually there is also delivered a spray, consisting of a mixture of a liquid and a gas (e.g. air and water), from the head 41 to the treatment site. Both, the liquid and the gas, are supplied through lines which are disposed in hose 4 and pass through the coupling 3 and the handpiece 40 to the head 41. Therefore also adapter 5 must be equipped with corresponding bores or lines for the liquid and the gas, those lines preferably passing the adapter 5 on its inside.

The adapter 5 may also have bores or lines for the transmission of energy which drives tool 42, for example compressed air for a turbine handpiece. If the adapter 5 is attached to a handpiece which is driven by a motor, and the motion produced by the motor is transferred to tool 42 via a shaft, the adapter 5 may also be provided with a bore for the shaft.